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Applicant: CALSONIC Corporation.

1. [Title of the Invention] Air-conditioning unit and air-conditioning apparatus for a vehicle

2. [Claims]

What is claimed is:

[Claim 1] An air-conditioning unit (30) for a vehicle comprising:

an air inlet (40) provided at a lower part of either right or left side wall of the vehicle;

an evaporator (32) provided at a lower part of the side wall of the vehicle;

a heater core (33) provided at an upper part of the evaporator; and

an air flowing surface (32b) of the evaporator arranged approximately horizontal direction; wherein:

the evaporator (32) is so provided that the air flowing surface (32b) slants either right or left with respect to air flowing direction (A1) along which air is introduced into the air inlet (40).

[Claim 2] An air-conditioning unit for a vehicle according to claim 1 wherein:

a slanting angle of the evaporator (32) is in the region

of 10 and 40 degrees.

[Claim 3] An air-conditioning unit for a vehicle according to claim 2 wherein:

the air inlet (40) is provided on a side wall in a space defined by a lower side of the air flowing surface (32b) of the evaporator and a bottom of a casing (31).

[Claim 4] An air-conditioning unit for a vehicle according to any one of claims 1 - 3 wherein:

a refrigeration tank (32a) of the evaporator is provided at the side of an engine room of the vehicle.

[Claim 5] An air-conditioning unit for a vehicle according to claim 4 wherein:

an expansion valve (EX) is attached to the refrigeration tank (32a) after penetrating through a dashboard panel (DP) of the vehicle and the casing (31) of the air-conditioning unit.

[Claim 6] An air-conditioning unit (30) for a vehicle comprising:

an air inlet (40) provided at a lower part of either right or left side wall of a vehicle;

an evaporator (32) provided at a lower part of the side wall of the vehicle;

a heater core (33) provided at an upper part of the evaporator; and

an air flowing surface (32b) of the evaporator arranged approximately horizontal direction; wherein:

a refrigeration tank (32a) of the evaporator is

provided at the side of an engine room of a vehicle.

[Claim 7] An air-conditioning unit for a vehicle according to claim 6 wherein:

an expansion valve (EX) is attached to the refrigeration tank after penetrating through a dashboard panel (DP) of the vehicle and a casing (31) of the air-conditioning unit.

[Claim 8] An air-conditioning unit for a vehicle according to any one of claims 1 - 7 wherein:

the heater core (33) is so provided that an air flowing surface (33b) thereof is arranged approximately horizontal direction.

[Claim 9] An air-conditioning unit for a vehicle according to any one of claims 1 - 8 wherein:

a vent air outlet (37), a defroster air outlet (38) and a foot air outlet (39) are formed on the upper side of the heater core (33).

[Claim 10] An air-conditioning apparatus for a vehicle wherein:

the air-conditioning unit (30) according to any one of claims 1 to 9 and an air-intake unit (10) with blower (14, 15) are provided along the left-right direction of the vehicle.

[Detailed Description of the Invention]

[0001]

[Industrial Field of Application]

The present invention relates to an air conditioning apparatus for a vehicle. The present invention particularly

relates to a vertically integrated type air conditioning apparatus in which an evaporator (a condenser, a heat exchanger for cooling) and a heater core (a heat exchanger for heating) are provided in an integrated unit at the upper side and at the lower side therein.

[0002]

[Prior Art]

Especially in the air-conditioning apparatus for passenger vehicles, in view of the increasing tendency of air conditioning apparatus installment to vehicles, it has been studied that an evaporator and a heater core are installed within single unit so that a conventional air-cooling unit can be abolished. This kind of air-conditioning apparatus for vehicles is often called a vertically integrated type air conditioning apparatus whereas the conventional cooling apparatus is called a horizontally integrated type air-conditioning apparatus, in which a cooling unit and heater unit are provided left-right direction.

[0003]

By integrating the air-cooling unit and the heater unit, not only foot area space of the vehicle becomes spacious but also cost for procuring material, manufacturing and assembling can be reduced.

[0004]

As the conventional vertically integrated type air-conditioning apparatus, one in which the evaporator and the heater core are provided approximately vertically in the

longitudinal direction of the vehicle (for example, JP-A-8-156570) or and the other in which the evaporator and the heater core are provided approximately horizontally in the up-down direction of the vehicle, are known.

[0005]

In the former conventional air-conditioning apparatus, air introduced from an air intake unit is carried down from the forward of the vehicle through the evaporator, the heater core and further down to the rear of the vehicle. On the other hand, in the latter conventional air-conditioning apparatus, air introduced from the air intake unit is introduced to the lower part of the side wall of the vehicle, is carried up to the evaporator, and further up to the heater core.

[0006]

[Problems that the Invention is to Solve]

In the conventional vertically integrated type air conditioning apparatus for vehicles, since the evaporator and the heater core, which are originally installed in separate unit, are designed to be installed in the same unit, it contains a potential problem of increasing air resistance within the unit. Also, in the above-described vertically integrated type air-conditioning apparatus for vehicles, although some improvements were made with respect to the arrangement of the evaporator, the heater core, and an air flow passage, the improvements have not been good enough.

[0007]

Also, when it comes to the placement of the evaporator

and the heater core, it is necessary to consider piping arrangement thereof. An arrangement relation between a refrigerant tank and an engine room as to the evaporator, and the same between a hot water tank and the engine room as to the heater core become important.

[0008]

For example, in the latter air-conditioning apparatus for vehicles, since a refrigerant tank of the evaporator is not in the vicinity of a dashboard panel (it is offset approximately in 90 degree direction from the dashboard panel), a refrigerant pipe connecting the refrigerant tank and a refrigerant cycle system in an engine room tends to be extended. Therefore, even an integrated type expansion valve with good assembling property cannot exhibit its full merits.

[0009]

In view of foregoing problems, it is an object of the present invention to provide a vertically integrated type air-conditioning apparatus for vehicles having small air flowing resistance as well as exhibiting merits of an integrated type expansion valve.

[0010]

[Means for Solving the Subjects]

In order to solve the above-described subjects, an air-conditioning unit according to claim 1 is characterized in comprising:

an air inlet provided at a lower part of either right or left side wall of a vehicle;

an evaporator provided at a lower part of the side wall of the vehicle;

a heater core provided at an upper part of the evaporator; and

an air flowing surface of the evaporator arranged approximately horizontal direction; wherein:

the evaporator is so provided that the air flowing surface slants either right or left with respect to the air flowing direction along which air is introduced into the air inlet.

[0011]

In the air-conditioning unit for a vehicle according to claim 1, the slanting angle of the evaporator is not specifically limited. However, the air-conditioning unit according to claim 2 is characterized in that it is defined in the region of 10 and 40 degrees.

[0012]

Also, in the air-conditioning unit for a vehicle according to claim 3 is characterized in that the air inlet is provided on a side wall in a space defined by a lower side of the air flowing surface of the evaporator and a bottom of a casing.

[0013]

In the air-conditioning unit for a vehicle according to claims 1 - 3, air is introduced from the lower part of the side wall of the air-conditioning unit and let air flow up to the evaporator and then to the heater core, towards the upper part of the vehicle. At this time, by slanting the evaporator either to left or right with respect to air flowing-down direction,

a space is formed between the air flowing surface under the evaporator and the bottom of the casing in accordance with the slanting angle, even when the evaporator is arranged very close to the bottom of the casing in the unit. In the present invention, the space is utilized as an air introducing space.

[0014]

However, if the slanting angle is too small, the capacity of the formed space itself or the opening area of the air inlet leading to the space become small accordingly. Thus, air flowing resistance might become larger, which is not favorable. To the contrary, if the slanting angle is too large, the evaporator becomes as near as upstanding state. As a result, not only the height of the unit becomes large, but also an air passage winds resulting in larger air flowing resistance, which is also not favorable.

[0015]

Therefore, in the air-conditioning unit for a vehicle according to the present invention, the air flowing resistance is reduced and the unit itself can be made compact by setting the slanting angle in the region of 10 and 40 degrees.

[0016]

In order to achieve the above-described object, in the air-conditioning unit for a vehicle according to claim 6 having an evaporator and a heater core, an inlet for air to be introduced formed at the lower part of a sidewall in the left-right direction of the vehicle, the evaporator disposed at the lower

side and the heater core disposed at the upper side, and an air flowing surface the evaporator disposed approximately in the horizontal direction, the refrigeration tank of the evaporator is characteristically provided by the side of an engine room of the vehicle.

[0017]

In the air-conditioning unit for a vehicle according to claim 6, since the refrigeration tank of the evaporator is located by the side of the engine room of the vehicle, the connecting length among the refrigeration cycle in the engine room becomes short, thus the piping arrangement of the refrigeration is remarkably simplified.

[0018]

In the air-conditioning unit according to claim 7, an expansion valve is characteristically attached to the refrigeration tank penetrating through a dashboard panel of the vehicle and the casing of the air-conditioning unit. By adapting the integrated type expansion valve in this way, since both the dashboard panel and the casing can be penetrated by the valve, the refrigeration piping by the air-conditioning unit side becomes unnecessary.

[0019]

In the air-conditioning unit for a vehicle according to the present invention, the layout of the heater core is not specifically limited. However, in the air-conditioning unit for a vehicle according to claim 8, the air flowing surface is characteristically arranged to be in the approximately

horizontal direction. Accordingly, the height of the air-conditioning unit is kept minimum, and the air passage is made also smooth. Therefore, air flowing resistance becomes also small.

[0020]

In the air-conditioning unit according to the present invention, the layout of each air outlet is not limited. However, in the air-conditioning unit according to claim 9, a vent air outlet, a defroster air outlet and a foot air outlet are characteristically provided at the upper side of the heater core.

[0021]

An air-conditioning apparatus for a vehicle exhibiting the above-described merits by the combination of the air-conditioning unit according to claims 1 - 9 with an air intake unit having a blower, and arranging them in left-right direction of the vehicle.

[0022]

[Embodiment]

An embodiment according to the present invention is explained hereinafter. First of all, the structure of an air-conditioning apparatus for a vehicle is explained with reference to figures.

Fig. 1 is a front view of an air-conditioning apparatus for vehicles according to an embodiment of the present invention. Fig. 2 is a plan view of the embodiment of the present invention. Fig. 3 shows a sectional view cut along the line III -III of the embodiment of the present invention. Fig. 4 is a perspective

view showing of an evaporator according to the embodiment of the present invention. Fig. 5 is a graph showing air flowing resistance with respect to a slanting angle of the evaporator according to the present invention.

[0023]

An air-conditioning apparatus for vehicle 100 is consisted of an air intake unit 10 and an air-conditioning unit 30. The air intake unit 10 has an air intake unit casing 11 and the air-conditioning unit 30 has an air-conditioning unit casing 31. The air intake unit casing 11 is connected to the air-conditioning unit casing 31 by a duct 20. As shown in Fig.2, the units 10 and 30 are installed along the dashboard panel DP of the vehicle in left-right direction. Although, it is not necessarily limited, the intake unit 10 is attached to an instrumental panel disposed around a foot area of a front passenger seat at the further back thereof, and the air-conditioning unit 30 is attached to a center console disposed in the center of the vehicle at the further back thereof.

[0024]

An outside- air inlet 12 for taking air in from outside of the vehicle and an inside-air inlet 13 for circulating inside air are formed on the air intake unit casing 11. The inside-air inlet 13 is formed open directly to the air intake unit casing 11 whereas the outside-air inlet 12 is communicated with the air intake unit casing via an inlet formed open on a caulpanel of a vehicle body and an air duct (neither shown).

[0025]

Although it is not shown, an air intake door is disposed pivotably to the air intake unit casing 11, moving about from a point where the outside-air inlet 12 is fully closed (an inside air circulation mode) to a point where the inside-air inlet 13 is fully closed (an outside air intake mode). The air intake door also stops in between the above points upon its necessity (inside-outside air intake mode). This pivotal moving of the air intake door is operated either by air-intake door actuator or a manual wire.

[0026]

Here, introducing the inside/the outside air is operated by a fan 15 rotated by a fan motor 14.

[0027]

As shown in Fig. 3, an air inlet 40 for taking in air blown from the air intake unit 10 further via duct 20 is disposed at the lower part of the side wall of the casing 31.

[0028]

In the vicinity of the air inlet 40, an evaporator 32 is provided for cooling the introduced air. The evaporator 32 constitutes an element of a refrigeration cycle being consisted by connecting a compressor, a condenser (an evaporator), an expansion valve EX, a fluid tank and so on. Since the main parts, such as the compressor, the condenser and the fluid tank are provided within an engine room, the evaporator 32 is connected with the foregoing elements by refrigerant piping communicating through the dashboard panel DP. Here, operating and stoppage of the refrigeration cycle is controlled by an-air conditioning

switch of a control panel provided on the instrumental panel in a vehicle room.

[0029]

A heater core 33 is provided on the upper side of the evaporator 32 of the air-conditioning unit case 31 so as to form a bypass passage 35. The heater core 33 is so provided that an air passage surface 33a thereof is to be in the up-down direction. An air-mixing door 34 disposed between the heater core 33 and the evaporator 32, that is to say, disposed on the front surface of the heater core 33, controls the ratio between the air flow volume flowing through a heater core 33 and the same flowing through the bypass passage 35.

[0030]

Here, at the heater core 33, cooling water for the engine is circulated and air is heated by the heat exchange between cooling water of the engine and air. Also, the air-mixing door 34 moves about from a position where the front surface 33a of the heater core 33 is fully closed (full-cooling) to a position where the bypass passage 35 is fully closed (full-heating) by way of an air mixing door actuator or a manual wire.

[0031]

The air-conditioning unit 30 in this embodiment functions to cool down air, which is blown from the air intake unit 10 at the evaporator. Then, the unit 30 performs hot-air conditioning at the heater core 33 and distributes the conditioned air to the vehicle room through any desired air-outlet. For this reason, at most upper part of the

air-conditioning unit case 31 (at the downstream side), an air-mixing chamber is formed. A vent air outlet 37, a defroster air outlet 38 and foot air outlet 39 are formed on the air-mixing chamber.

[0032]

The vent air outlet 37 is communicated directly with a vent grill provided on the front surface of the instrumental panel in the vehicle room or is communicated with the same via an air duct, and mainly blows the conditioned air towards a torso of a passenger. The defroster air outlet 38 is communicated directly with a defroster grill provided on the upper surface of the instrumental panel or is communicated with the same via the air duct, and blows air with low-humidity or hot air to the inner surface of windshield to clear fogging thereon. The foot air outlet 39 is provided open around the foot area of the passenger in the vehicle room and blows out mainly hot air around the foot area of the passenger.

[0033]

A vent door 37D, a defroster door 38D and a foot door 39D are provided respectively to the air outlets 37, 38 and 39 so as to open each door 37, 38 and 39. The doors 37D, 38D and 39D are operated by a mode actuator via a link mechanism or by the manual wire.

[0034]

That is to say, by selecting a mode from a vent mode, a defroster mode, a bi-level mode or a foot mode, each door is operated depending upon combination of open/closed state of these

three doors 37D, 38D and 39D. For example, at the bi-level mode, both vent air outlet 37 and foot air outlet 39 are half-open so that cooling air is blown out from the vent air outlet 37 and hot air is blown out form the foot air outlet 39. Thus cooling air blows towards head area of the passenger whereas hot air blows towards foot area of the same, which is comfortable for the passenger.

[0035]

In the air-conditioning unit 30 of the air conditioning apparatus for vehicles 100 according to this embodiment, a sub air-mixing door 36 is provided at the back surface of the heater core 33. The sub air-mixing door 36 is connected by the link mechanism so that it operates along with the movement of the air-mixing door 34. The sub air-mixing door 36 is provided for heighten a mixing property of hot air with cooling air in the air mixing chamber. For example, in the hot air conditioning region in which the air-mixing door 34 moves about halfway, the sub air-mixing door 36 also moves about halfway. Thus, a part of air passed through the heater core 33 is guided by cooling air blown down through the bypass passage 35 resulting in improving air-mixing property.

[0036]

Especially in the air-conditioning unit 30 according to this embodiment, the evaporator 32 is so arranged that an air flowing surface 32b of the evaporator 32 is slanted either right or left with respect air flowing direction along which air is introduced into the air inlet 40.

An explanation will be given by referring to the Fig. 4. Fig. 4 is a perspective view looking from the rear side of Fig. 3. In this figure, an engine room is at the left hand side and the air-intake unit 10 is the lower left hand side. Air introduced by the air intake unit 10, is introduced to an air inlet 40 of the air-conditioning casing 31 via duct 20, along the direction indicated by an arrow A1. The evaporator 32 in this embodiment is arranged so that an air flowing surface 32a of the evaporator 32 is slanted to down right, viewing the evaporator 32 in the direction indicated by the arrow A1.

[0037]

The slanting angle è of the evaporator 32 is preferably in the region of 10 to 40 degrees. As shown in Fig. 4, this is because air introduced into the evaporator 32 from the side thereof passes along the evaporator in the upward direction. Therefore, if the slanting angle è is smaller than 10 degree, which means as near as to the horizontal direction, an opening area of the air inlet 40 also becomes small inducing an increase in air flowing resistance.

[0038]

Fig. 5 is a graph showing experimental results in measuring the air flowing resistance in accordance with changes of the slanting angle of the evaporator. It is confirmed that the smaller the slanting angle of the evaporator 32 becomes, the drastically larger the air flowing resistance becomes. Here, however, the air flowing resistance in the event of combination with the heater core 33 as shown in Fig. 3 is not indicated.

[0039]

When the slanting angle of the evaporator 32 is large, that is to say, it is disposed as near as upright direction, the opening area of the air inlet 40 increases. However, the height measurement also increases along with standing of the evaporator 32. Also, the air passage coming through the evaporator 32 is wound since air is introduced from the air-inlet 40. For these reasons, the air flowing resistance increases.

[0040]

When the evaporator 32 is disposed slanting in the air-conditioning unit 30 of this embodiment, a refrigerant tank 32a is arranged by the side of the engine room. It is sufficient to place the refrigerant tank 32a either by the side of the engine room or outside of the engine room, considering the air flowing resistance and the height of the air-conditioning unit 30 only. However, by arranging the refrigerant tank 32a by the side of the engine room, as shown in Fig. 3, effects obtained by adapting an integrated type expansion valve EX are remarkable.

[0041]

That is to say, in this embodiment, a cylindrical protrusion 31a penetrating a dashboard panel DP is formed on the air-conditioning unit casing 31. The integrated type expansion valve EX is fixed to the cylindrical protrusion 31a penetrating the dashboard panel DP. A refrigerant inlet for taking in the refrigerant from the refrigeration cycle and a refrigerant outlet for pushing out the refrigerant to the cycle are formed on the integrated type expansion valve, and both the

inlet and outlet are communicated with the refrigeration tank 32a. Also, since the main body of the expansion valve and the temperature sensor are contained within, piping arrangement required for disposing the expansion valve and the temperature sensor becomes remarkably simplified. By employing this kind of integrated type expansion valve, the refrigeration piping by the vehicle room side is simplified in the air-conditioning unit 30 of this embodiment. Also the connecting work for the refrigeration cycle can be made from the engine room side only.

[0042]

Next, each function in a full cooling mode, a full hot mode and a temperature-conditioned mode will be explained. Fig. 6 shows air flow in the full cooling mode, Fig. 7 shows the same in the full cooling mode and the Fig. 8 shows the same in the temperature-conditioned mode respectively.

[0043]

First of all in the full cooling mode, as shown in the Fig. 6, both the defroster air outlet 38 and the foot air outlet 39 are fully closed whereas the vent air-outlet 37 is fully opened. The air-mixing door 34 fully closes the heater core 33. The open/close status of the sub air-mixing door is not restricted here.

[0044]

Accordingly, air introduced to the air inlet 40 from the air intake unit 10 flows upwardly along the air flowing surface 32b of the evaporator 32, further flows through the bypass passage 35, to the vent air outlet 37. Like this way, in the full cooling

mode, since the air passage from the air inlet 40 to the vent air outlet 37 is formed almost linear, resulting in particularly small air flowing resistance. Therefore, it is possible to provide voluminous cooling air to the inside of the vehicle room.

[0045]

In the full hot mode, as shown in Fig. 7, the defroster air outlet 38 and the vent air outlet 37 are fully closed whereas the foot air outlet 39 is fully opened. The air-mixing door 34 fully opens the heater core 33.

[0046]

Accordingly, air introduced to the air inlet 40 from the air intake unit 10 flows upwardly along the air flowing surface 32b of the evaporator 32, further flows through the heater core 33 guided by the heater core 33 at the air-mixing door 34, to the foot air outlet 39. Also, in the full hot mode, since the air passage from the air inlet 40 to the foot air outlet 39 is formed almost linear resulting in particularly small air flowing resistance. Therefore, it is possible to provide voluminous cooling air to the inside of the vehicle.

[0047]

Still further, in the air-conditioned mode providing air of intermediate temperature as well as in the bi-level mode, as shown in Fig. 8, the defroster air-outlet 38 is fully closed whereas the vent air outlet 37 and the foot air outlet 39 are half-opened. The air-mixing door 34 is approximately in the intermediate position and the sub air-mixing door 36 is also approximately in the intermediate position.

[0048]

Air introduced to the air inlet 40 from the air intake unit 10 flows upwardly along the air flowing surface 32b of the evaporator 32. At the air-mixing door 34, air is separated into one guided by the heater core 33 and the other guided by the bypass passage 35. Also, hot air flowing through the heater core 33 is further separated into hot air flowing to the foot air outlet 39 and hot air detoured to the side of the bypass passage 35. Hot air detoured to the side of the bypass passage 35 collided with cool air flowing upwardly along the bypass passage 35 by the sub air-mixing door 36. Air with adequate temperature produced by mixing of cool air with hot air flows to the vent air outlet 37.

[0049]

Also, in the temperature-adjustment mode, since the air passage from the air inlet 40 to the vent air outlet 37 and to the foot air outlet 39 are formed almost linear resulting in particularly small air flowing resistance. Therefore, it is possible to provide voluminous conditioned air to the inside of the vehicle room. In addition, since hot air collides with cool air at approximately perpendicular angle by the sub-air mixing door 36, air-mixing property of hot and cool air improves. Therefore, uncomfortableness caused by wide temperature difference between the head area (cool air area) and the foot area (hot air area) of the passenger diminishes. Further, by consisting the sub air-mixing door 36 being independently movable, temperature difference between the head area and the foot area

of the passenger can be changed as one desires.

[0050]

The above-described embodiment is for facilitating understanding the present invention, and is not for unnecessarily giving limitations to the present invention. Therefore, each element described above applies to any kind of modifications or equivalents within the scope of the present invention.

[0051]

As described above, the present invention has made it possible to provide a compact air-conditioning unit for vehicles having small air flowing resistance as well as an air-conditioning apparatus for vehicles.

[0052]

Also, refrigeration piping arrangement required with respect to the refrigeration cycle is remarkably simplified, especially effects are outstanding when the integrated type expansion valve is used.

[Brief Description of the Drawings]

Fig. 1 is a front view of an air conditioning apparatus for a vehicle according to an embodiment.

Fig. 2 is a flat view of Fig. 1.

Fig. 3 is a sectional view of Fig. 1 taken along line III -III.

Fig. 4 is a perspective view of an evaporator of the present invention.

Fig. 5 is a graph showing flowing air resistance with respect to a slanting angle of the evaporator of the present

invention.

Fig. 6 shows a sectional view of airflow during a full cooling mode of the present invention.

Fig. 7 shows a sectional view of airflow during a full hot mode of the present invention.

Fig. 8 shows a sectional view of airflow during a temperature-adjustment mode.

[Explanation of Reference Numerals]

10 ... air intake unit, 14 ... fan motor (blower), 15 ... fan (blower), 20 ... duct, 30 ... air-conditioning unit, 31 ... air-conditioning casing, 31a ... cylindrical protrusion, 32 ... evaporator, 32a ... refrigerant tank, 32b ... air flowing surface, 33 ... heater core, 33a ... air flowing surface, 34 ... air-mixing door, 35 ... bypass passage, 36 ... sub air-mixing door, 37 ... vent air outlet, 38 ... defroster air outlet, 39 ... foot air outlet, 40 ... inlet, EX ... expansion valve, and DP ... dashboard panel

[Title of Document] ABSTRACT

[Abstract]

[Subject] To provide an air-conditioning unit and an air-conditioning apparatus for vehicles in which air flowing resistance is small, and the merits of an integrated type expansion are fully exhibited.

[Means for Solving the Problems] An evaporator 32 and a heater core 33 are provided. An air inlet 40 for introducing air is disposed at lower part of either left or right side wall of a vehicle. The evaporator 32 is disposed at the lower side and the heater core is disposed at the upper side. Further, the evaporator 32 is so provided that an air flowing surface 32b is arranged approximately upright. That is to say, the evaporator 32 is provided so that the air flowing surface 32b is slanted by 10 to 40 degrees with respect to the air flowing-down direction, which is introduced through an air-outlet 40.

【００４９】このように、温調モードにおいても、入口４０からベント吹出口３７またはフット吹出口３９に至る空気流路がほぼ直線状に形成されているので、通気抵抗がきわめて小さく、大風量の温調空気を室内へ供給することができる。しかも、サブミックスドア３６によって温風が冷風へ略直角方向に衝突するので、混合性が高まり、頭寒足熱の違和感が抑制できる。また、サブミックスドア３６を単独で作動可能に構成すれば、頭寒足熱の差温も自由に変えることができる。

【００５０】なお、以上説明した実施形態は、本発明の理解を容易にするために記載されたものであって、本発明を限定するために記載されたものではない。したがって、上記の実施形態に開示された各要素は、本発明の技術的範囲に属する全ての設計変更や均等物をも含む趣旨である。

【００５１】

【発明の効果】以上述べたように本発明によれば、通気抵抗が充分に小さく、かつ小型の自動車用空調ユニットおよび自動車用空気調和装置を提供することができる。

【００５２】また、エンジンルーム内の冷房サイクルとの冷媒配管の取り廻しが著しく簡略化され、特に一体型膨張弁を採用したときの効果が著しい。

【図面の簡単な説明】

【図１】本発明の自動車用空気調和装置の実施形態を示す正面図である。

【図２】図１の平面図である。

【図３】図１のIII-III 線に沿う断面図である。

【図４】本発明に係るエバポレータを示す斜視図である。

【図５】本発明のエバポレータの傾斜角度に対する通気抵抗を示すグラフである。

【図６】本発明のフルクールモードにおける空気流を示す断面図である。

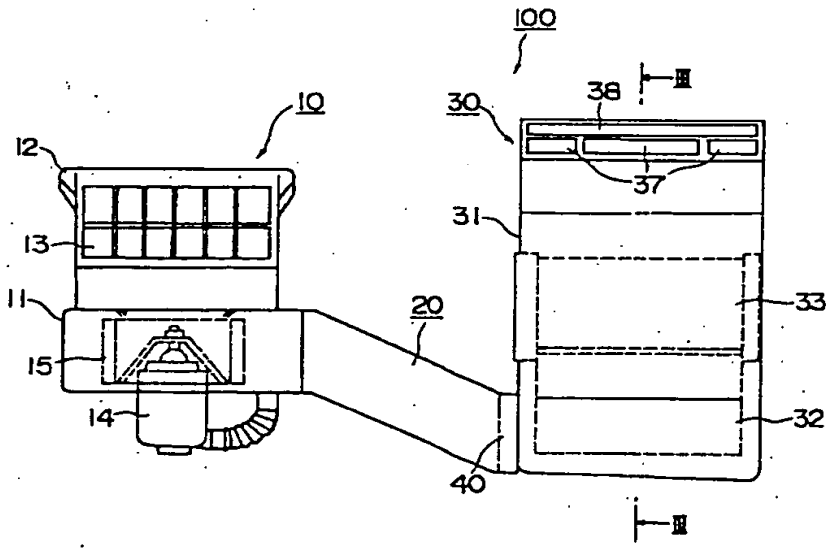
【図７】本発明のフルホットモードにおける空気流を示す断面図である。

【図８】本発明の温調モードにおける空気流を示す断面図である。

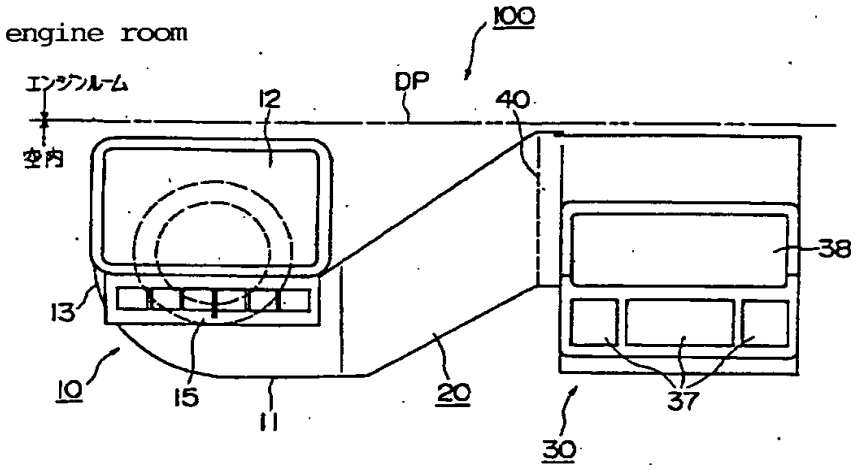
【符号の説明】

１０…インテークユニット
１４…ファンモータ（送風機）
１５…ファン（送風機）
２０…ダクト
３０…空調ユニット
３１…ケーシング
３１ａ…筒状突起部
３２…エバポレータ
３２ａ…冷媒タンク
３２ｂ…空気通過面
３３…ヒータコア
３３ａ…空気通過面
３４…ミックスドア
３５…バイパス路
３６…サブミックスドア
３７…ベント吹出口
３８…デフロスト吹出口
３９…フット吹出口
４０…入口
ＥＸ…膨張弁
ＤＰ…ダッシュパネル

【図１】 Fig. 1



【図2】 Fig. 2



【図3】 Fig. 3

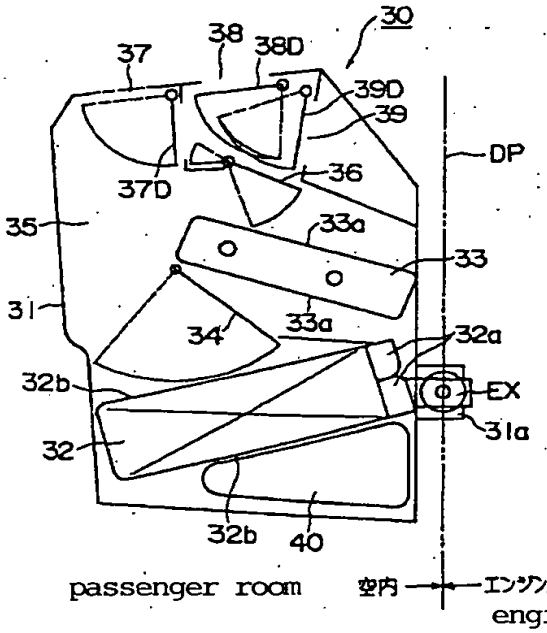
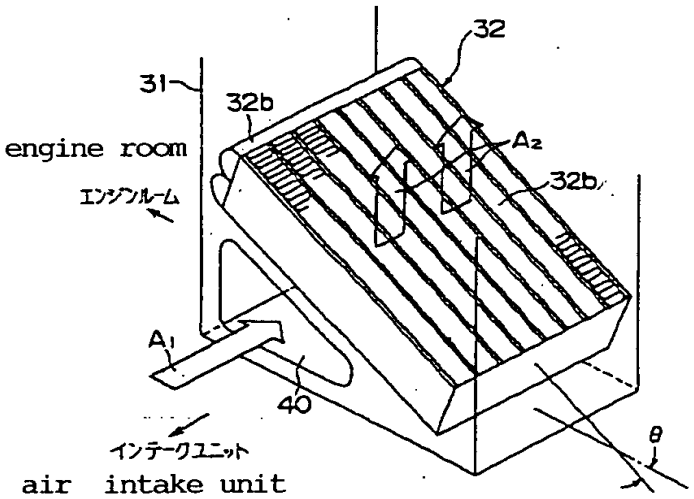
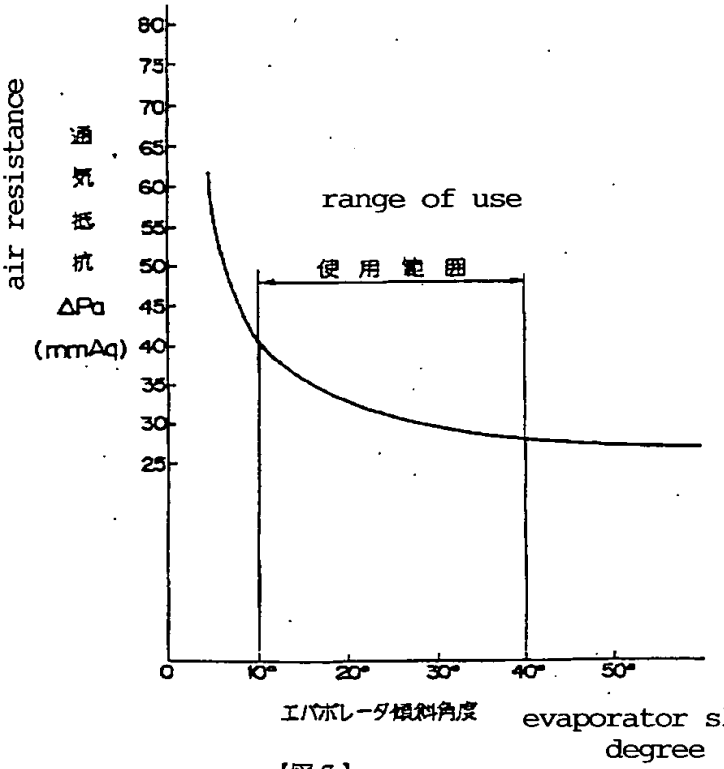


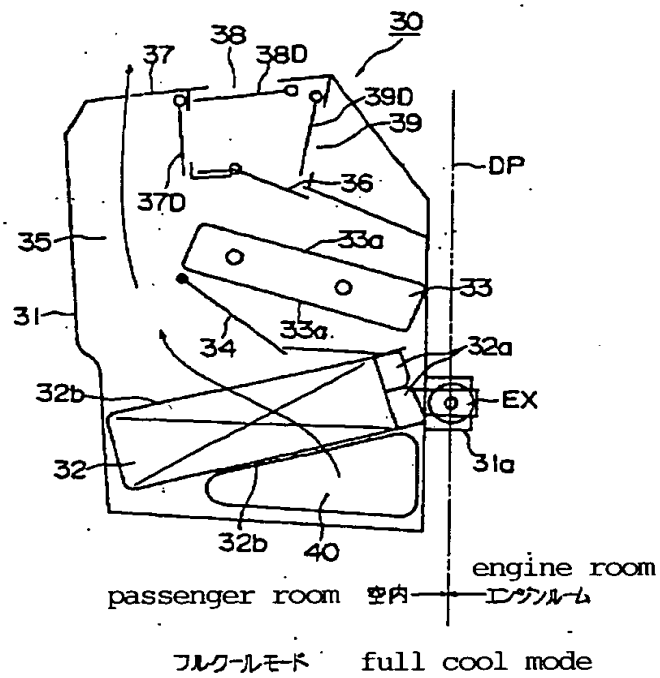
Fig. 4 【図4】



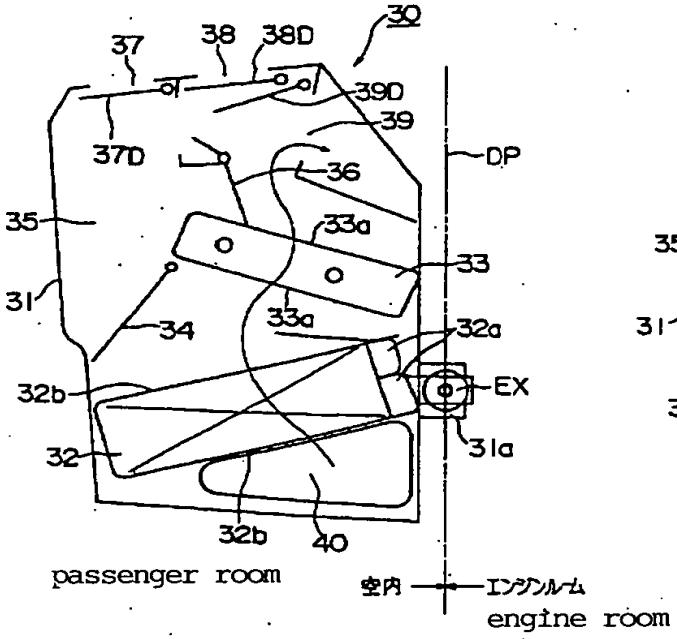
【図5】 Fig. 5



【図6】 Fig. 6



【図7】 Fig. 7



【図8】 Fig. 8